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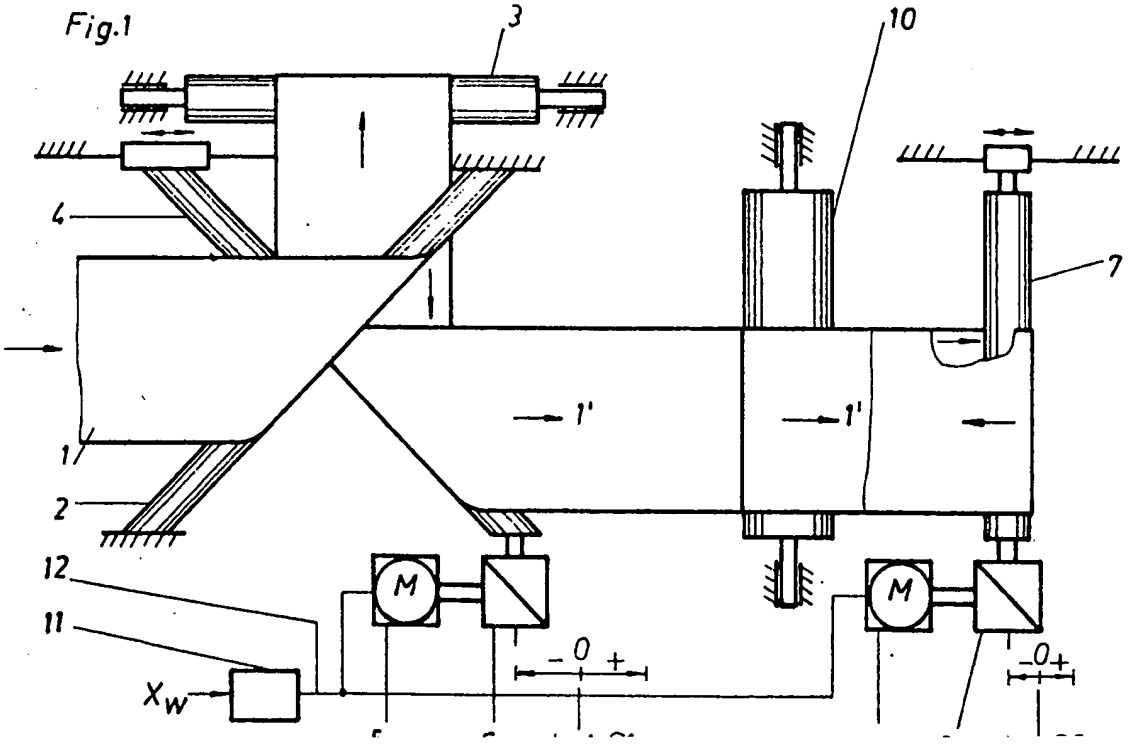
(54) Material web turning apparatus

(57) Material web turning apparatus comprises a position-controlled displaceable turning rod (4) and a position-controlled displaceable longitudinal register cylinder (7), the rod (4) and the cylinder (7) being positionally coupled. For electrical positional coupling, an output of a regulating device (11) can be connected by way of a common signal transmission path (12) with a setting motor (5) for positional resetting of the rod (4) and with a setting motor (8) for positional resetting of the cylinder (7). A control signal proportional to and counteracting the deviation of the web edge position is provided at this output by the regulating device (11) and applied to both motors (5, 8). A transmission (9) associated with the cylinder (7) has such a translation ratio as to effect positional resetting of the cylinder (7) by an amount compensating for the web path change caused by positional resetting of the rod (4).

Fig.1



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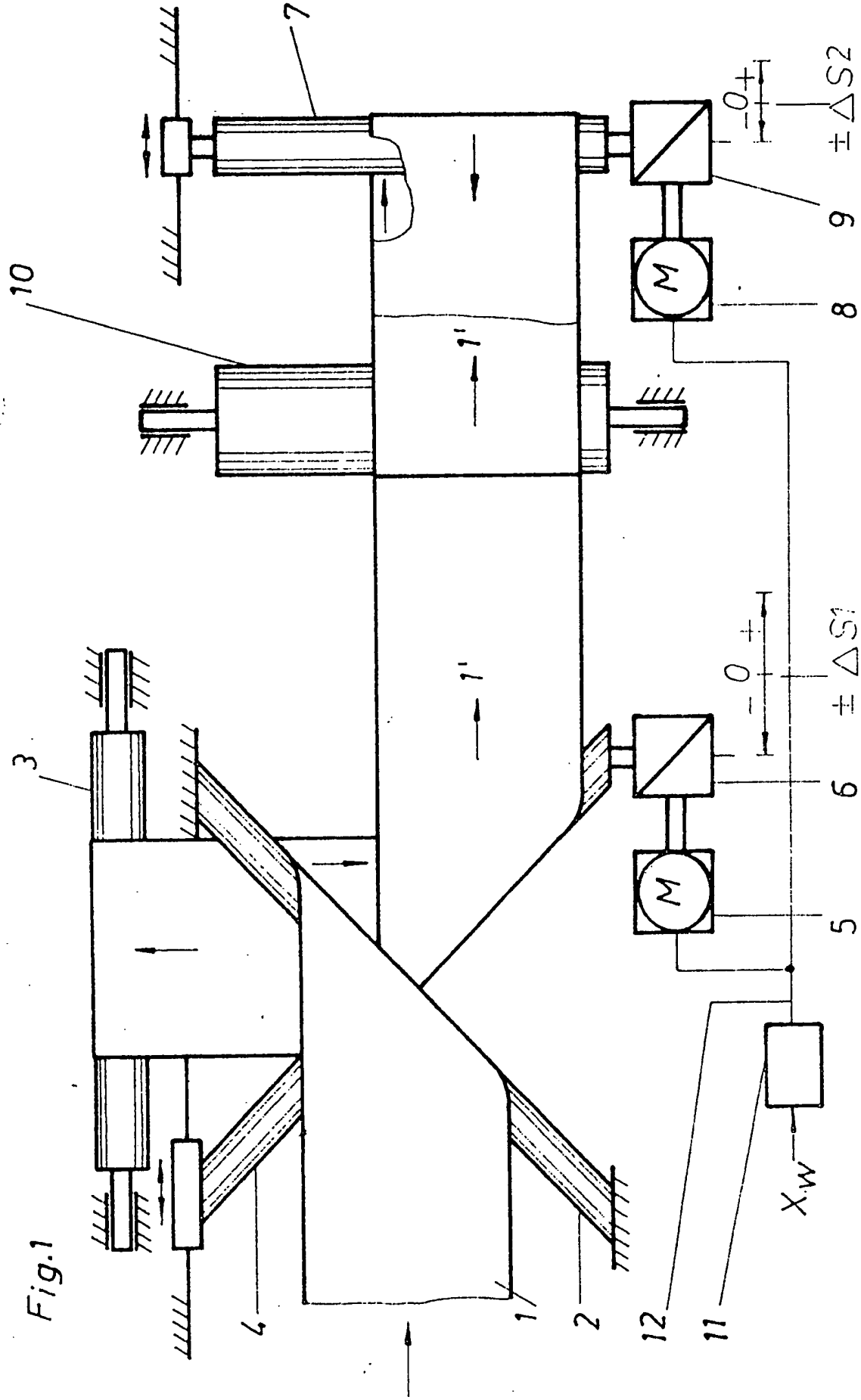

Fig.1

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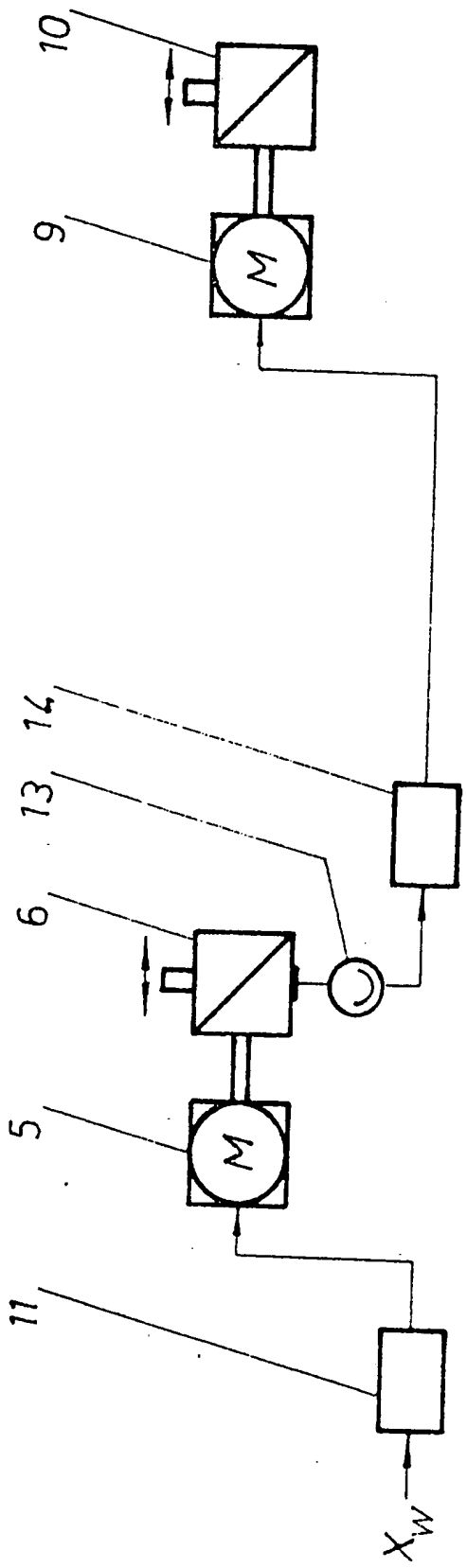

Fig. 2

SPECIFICATION

Material web turning apparatus

The present invention relates to turning apparatus for turning a web of material, especially a continuously moved web of material in a rotary printing machine, where the web must be moved true to register.

Turning rods, which are flowed around by air and arranged singly or in pairs according to their task and are pivotable or displaceable for the lateral alignment of the web, are used in rotary printing machines for the guidance of paper webs and imparting to them a change in direction, transfer into another plane of movement, lateral alignment and turning.

For example, a moved printed paper web may be cut longitudinally and the web portions guided congruently one above the other with the aid of a turning rod arrangement for entry into a folding funnel in the folding apparatus. In this case, positionally displaceable longitudinal register rollers are employed between the turning rod arrangement and the folding apparatus for each web portion for the elimination of differences between the longitudinal registers at the folding apparatus. The separate or coupled presetting of turning rods and longitudinal register rollers is known and described in DD-PS 45 726.

The low-reject regulating-out of rapid changes in the web edge position by means of co-operating pivotable and locally fixed web guide rollers, which is customary in other regions of the printing machine, is very disadvantageous between the turning rod arrangement and the folding apparatus.

Turning stations with a processing capacity of two webs, which are longitudinally cut and guided one above the other as four web portions, would require a plugged arrangement of eight such web guiding devices, which would have the consequence of an unacceptable web height of the printing machine.

Moreover, very long web paths would be required for compensation for lateral displacement of the web by, for example, half a web width.

Known solutions, for example as described in DE-OS 29 20 684, employ, as a setting member for the web edge position, pivotable or displaceable turning rods in conjunction with a motorised setting drive consisting- of a motor for rotational movement and an adapting gear for conversion of the rotational movement into a translational movement corresponding to a transmission ratio between rotational motor angle and displacement travel for the turning rod.

A basic disadvantage of these devices is that the displacement of the turning rod inevitably causes changes in the web travel length between the last printing unit and the folding tudinal register errors arise, which require the additional use of a longitudinal register regulation for each web portion.

A particular disadvantage of the longitudinal register regulation arranged downstream of a positionally controlled turning rod is the relatively high reject rate connected therewith. For the compensating time t_a during the regulating-out of step-shaped interference magnitude influences by a web position regulation, there generally applies $t_a \approx 3.L/v$, wherein L is tie web travel of the compensating process and v is the web speed. By comparison with the compensation for a web edge positional change, which takes place on the relatively short travel between the turning rod and the intake at the folding apparatus, the compensation for the longitudinal register change requires the relatively long travel between the intake in front of the turning station and the intake at the folding apparatus. Moreover, the longitudinal register·compensation commences with a delay with respect to the web edge position compensation. In the case when co-operation of a longitudinal register regulation with a web edge position regulation causes a longitudinal register error, reject waste arises in the time span which starts when the web edge, after an interference magnitude influence, leaves a tolerance range and which ends when the longitudinal register at the folding apparatus re-enters and remains in the tolerance range.

It is also disadvantageous, in the case of a downstream longitudinal register regulation, that a step-shaped positional displacement of the turning rod, which is desired for rapid correction of the web edge position, has the consequence of a step-shaped extension of the web with the danger of excess stretching or tearing of the web.

There is thus scope for improvement of measures for regulation of the position of a continuously moved web of material in, for example, a rotary printing machine so as to reduce standstill times and printers waste and permit the printer to concentrate on monitoring of the printing process itself.

According to the present invention there is provided material web turning apparatus comprising a rod for turning of a material web therearound, first drive means for displacing the rod to laterally displace the web, a guide cylinder for guidance of the web therearound, and second drive means for displacing the cylinder in the longitudinal direction of the web, the rod and the cylinder being positionally coupled with each other.

The positional coupling between the turning rod and the longitudinal register cylinder can be realised mechanically, electrically as well as by way of the web. An electrical positional coupling is particularly advantageous.

For electrical positional coupling, regulating

web edge position regulation for acting on a setting motor for the positional displacement of the turning rod and a further control signal, which is proportional to and counteracts the regulation deviation of the web edge position, at an output which is connected with a setting motor for the positional displacement of the cylinder. The regulating equipment generates the control signal for the positional displacement of the longitudinal register cylinder with such a factor of proportionality that the web travel change, which is caused by the positional displacement of the rod, is compensated for by the positional displacement of the cylinder.

In another embodiment, that output of regulating equipment at which a control signal is provided for the web edge position regulation is connected by way of a common signal transmission path with a setting motor for the positional displacement of the turning rod as well as with a setting motor for the positional displacement of the longitudinal register cylinder. A transmission associated with the cylinder setting motor has such a traismission ratio between rotational motor angle and setting travel that the web travel change, which is caused by the positional displacement of the turning rod, is compensated for by the positional displacement of the cylinder.

In yet another embodiment, a displacement sensor is arranged in fixed location with the turning rod and controlled by the rod displacement, the sensor being connected by way of a signal transmission path with control equipment and signalling to this the displacement travel of the turning rod according to direction and amount. The control equipment can then provide a control signal, which is proportional to and counteracting the rod displacement, at an output which is connected with a setting motor for positional displacement of the cylinder.

Preferably, the setting motors are electric stepping motors for incremental positioning of the rod and cylinder, which motors receive a control signal in the form of a pulse sequence. The sensor for signalling the displacement of the rod can be a digital, incremental sensor. In place of a special position-controlled longitudinal register roller, there can be used the longitudinal register roller of a longitudinal register regulation system of, for example a system for cutting register regulation in folding apparatus.

Embodiments of the present invention will now be more particularly described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a schematic plan view and circuit diagram of first apparatus embodying the invention; and

Fig. 2 is a circuit diagram of second apparatus embodying the invention.

Referring now to the drawings, there is shown in Fig. 1 web turning apparatus in which a continuously moved paper web 1 is deflected to the left through an angle of 90° by a turning rod 2, which is mounted in a fixed location at both ends in a machine frame, flowed around by air and forms an angle of 45° with the web edge at the right in direction of movement. The web is then reversed in direction by a deflecting roller 3, which is mounted in a fixed location and looped around by the web through an angle of about 180°. Thereafter the web is fed to a turning rod 4, which is flowed around by air and forms an angle of 45°, the rod 4 being displaceable at both ends in the machine frame. The web is so deflected by the rod 4 that, as turned web 1, it has the same direction of movement but is laterally displaced with respect to the incoming web 1. The displacement of the rod 4 in or against the direction of movement of the turned web 1′ is by way of a setting motor 5 and adapting gear 6 and effects lateral displacement of the turned web 1′ to the left or right. At the same time, however, this creates a downstream longitudinal register error through the shortening or lengthening of the web travel.

The turned paper web 1 is subsequently guided over a longitudinal register cylinder or roller 7, which is mounted in the machine frame to be displaceable parallelly at both sides in or against the direction of movement of the web, and thereafter over a deflecting cylinder 10, which is mounted in a fixed location in the machine frame, with pressing roller equipment (not illustrated). The web loops around each of the roller 7 and cylinder 10 by an angle of about 180°. The displacement of the roller 7 in or against the direction of movement of the turned web 1 by way of the setting motor 8 and the gear 9 effects the correction of longitudinal register error due to lengthening or shortening of the web travel.

The apparatus includes regulating equipment 11 for the web edge position regulation, an output of which is connected by way of a common signal transmission path 12 with the setting motors 5 and 8. The gear 9 associated with the motor 8 has such a translation ratio between motor rotational angle and setting travel for the roller 7 that a web travel change resulting from the positional displacement of the rod 4 is compensated for.

On the occurrence of a web edge position deviation of the turned web 1, the regulating equipment 11 generates a control signal proportional to and counteracting the regulating deviation x_w and thereby acts simultaneously on the setting motors 5 and 8. Shortening of the web travel through positional displacement of the rod 4 corresponds to lengthening of the web travel through positional displacement of the roller 7 and vice versa, so that a longitudinal register error resulting from the positional displacement of the rod 4 does not

arise.

Preferably, the regulating equipment 11 generates the control signal in the form of a rectangular pulse sequence characterised by the pulse quantity i, the pulse repetition frequency and directional information, and thereby acts simultaneously on electrical stepping motors, serving as the setting motor 5 and 8, for incremental positioning of the rod 4 and roller 7, wherein the motors 5 and 8 execute a movement which is characterised by the rotational angle $a = \Sigma_i a_s$ (a_s = step angle), the angular speed $\omega = da/dt$, and the direction of rotation.

Fig. 2 shows a second embodiment. A travel sensor 13 is firmly connected with the turning rod 4 and coupled to the input of control equipment 14, the output of which is connected with the setting motor 8 for the positional displacement of the roller 7.

The sensor 13 controlled by the travel of the turning rod 4 signals the displacement, according to direction and amount, to the control equipment 14, which generates a control signal proportional to and counteracting the traversed displacement travel and thereby acts on the setting motor 8.

Preferably, the sensor 13 is a digital, incremental travel pick-up and the setting motor 8 is an electrical stepping motor.

There is no restriction, however, just to these embodiments. Further embodiments are feasible, which have in common the positional control of the longitudinal register roller 7 through the control magnitude of the web edge position regulation or through the interference magnitude of the turning rod displacement.

A particular advantage of this simple arrangement results from the elimination of the expensive equipment for longitudinal register regulation (sensor for detection of the longitudinal register, measurement transformer, regulating equipment), except for the setting drive (setting motor with adapting gear) and the setting member (longitudinal register roller). This advantage is particularly important when several web portions each require respective longitudinal regi ster regulation.

It is also advantageous that a time-saving rapid setting of the lateral and longitudinal register at folding apparatus is possible when adapting the machine to different production variants.

CLAIMS

1. Material web turning apparatus comprising a rod for turning of a material web therearound, first drive means for displacing the rod to laterally displace the web, a guide cylinder for guidance of the web therearound, and second drive means for displacing the cylinder in the longitudinal direction of the web, the rod and the cylinder being positionally coupled with each other.

2. Apparatus as claimed in claim 1, wherein each of the first and second drive means comprises a respective electrically controllable motor connected to respective control signal output means of web position regulating means, the regulating means being arranged to provide a first control signal to cause the rod drive motor to displace the rod for lateral displacement of the web and a second control signal to cause the cylinder drive motor to displace the cylinder for longitudinal adjustment of the web path by such an amount as to compensate for change in the web travel due to the lateral displacement of the web.

3. Apparatus as claimed in claim 1, the first and second drive means comprising two electrically controllable motors connected to common control signal output means of web position regulating means arranged to provide a control signal to cause the rod drive motor to displace the rod for lateral displacement of the web and the cylinder drive motor to displace the cylinder in the longitudinal direction of the web, and the cylinder drive motor being drivingly coupled to the cylinder by transmission means having such a drive transmission ratio that said cylinder displacement effects adjustment of the web path by an amount sufficient to compensate for change in the web travel due to the lateral displacement of the web.

4. Apparatus as claimed in claim 1, comprising sensing means to sense and provide a signal indicative of the direction and amount of any such rod displacement and control means so responsive to such signal as to cause the second drive means to displace the cylinder for longitudinal adjustment of the web path by such an amount as to compensate for change in the web travel due to the lateral displacement of the web by the rod displacement.

5. Apparatus as claimed in claim 4, the sensing means being a digital incremental travel sensor.

6. Apparatus as claimed in any one of the preceding claims, wherein each of the first and second drive means comprises an electric setting motor controllable a control signal in the form of a pulse sequence.

7. Apparatus substantially as hereinbefore described with reference to Fig. 1 of the accompanying drawings.

8. Apparatus substantially as hereinbefore described with reference to Fig 2 of the accompanying drawings.

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